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Anxiety and depression in coronary artery bypass surgery patients: A prospective clinical study

Mood disturbances and open heart surgery

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Abstract
Aim: A prospective view on the incidence of depression and anxiety in coronary artery bypass graft (CABG) surgery may reveal the importance of psychological support as a part of cardiac rehabilitation. This study aims to determine depression and anxiety levels of CABG patients in the preoperative and postoperative periods, and their correlation with demographic data and length of hospital stay.
Material and Methods: Ninety-eight patients undergoing elective first CABG surgery were assessed in terms of depression and anxiety using Beck Depression Inventory (BDI) and Beck Anxiety Inventory (BAI) on day before, 3 days after, 7 days after and 30 days after surgery. Age, gender, length of hospital stay, and profession were also evaluated to see whether they affect depression and anxiety.
Results: In patients, (60 males, 38 females, mean age 46±6.54, range of 43-76 years) the levels of depression and anxiety symptoms were higher on the postoperative 3rd and 7th days than in the preoperative period ($p<0.001$).
Discussion: Depression and anxiety affect postoperative outcomes and recovery after cardiac surgery. Psychological preventive counseling and a detailed explanation of cardiac surgery may reduce patients' emotional stress, medical and economic costs.

Keywords
Anxiety, Cardiac Surgery, Depression

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Introduction

Since the relation between psychosomatic medicine and coronary artery disease was first described in 1979 [1], the effects of depression and anxiety on coronary artery disease have been defined in many studies [2–4]. Fewer studies are devoted to depression and anxiety in CABG patients in the pre-and postoperative period [5,6]. Tested quality of life after successful CABG remains low in nearly 25-40% of patients [7]. Low levels of depression and anxiety before surgery are associated with the absence of cardiac symptoms for 6 months after CABG [8]. Unsatisfactory results after CABG as a result of depression and/or anxiety revealed the necessity of more studies in this field.

In studies that examined depression and anxiety in CABG patients, age, gender, occupation, and length of hospital stay were found to be the most related factors, but to our knowledge, there is no study examining all these factors in the pre-and postoperative period in CABG patients. Our study is aimed, in particular, at raising awareness of stress by determining the levels of depression and anxiety in the pre-, peri- and postoperative periods in CABG patients, and their relation with age, gender, occupation, and length of hospital stay.

Material and Methods

Design and Sample

The study population consisted of patients who were hospitalized for preoperative evaluation for first-time, elective isolated on-pump CABG. All patients fulfilled the following criteria: native Turkish speaker, ability to read and write, no psychiatric history/medications, no neurological deficit, no dementia, no emergency CABG surgery, and written consent to participate. Patients with additional procedures (valve surgery, aortic surgery, carotid artery endarterectomy, etc.) or off-pump CABG were excluded in order to have a homogeneous population.

In our study, it was planned to include 125 patients. Fifteen patients declined to participate, 9 patients were excluded in the preoperative period, one patient died on the postoperative second day, and the questionnaire data of 2 patients were missing (Figure 1).

As a result, the study was conducted with 98 patients (mean age: 59.46±6.54 years, ranging between 43 and 76 years, 38.8% females), who underwent CABG surgery at our institution from September 2019 to February 2020.

Measurement

Depression and anxiety were measured with Beck Depression Inventory (BDI) and Beck Anxiety Inventory (BAI).

The BDI and the BAI were developed by Beck et al. to measure behavioral signs of depression in adolescents and adults, and for rating anxiety. In BDI, scores were summed, scores with a range of 0 to 63 indicate levels of depression (a score from 0 to 9 indicates no depression, 10-16 mild depression, 17-29 moderate depression, and 30-63 severe depression). The BAI consists of 21 questions, scores ranging from 0 to 63 indicate levels of anxiety (a score from 0 to 7 indicates no anxiety, 8-15 mild anxiety, 16-25 moderate anxiety, and scores≥ 26 indicate severe anxiety).

Procedure

All patients were operated by the cardiovascular team of our clinic, on-pump CABG. The proximal anastomosis was performed under either cross-clamp or side-clamp regarding aortic calcification.

After obtaining informed consent, patients completed two questionnaires sequentially four times: the day before, on the 3rd, 7th, and 30th days after the surgery. They were taken to a quiet room and completed the tests alone. Preoperative, postoperative assessments on days 3 and 7t were done with in-hospital patients, while the tests were performed at an out-patient visit on postoperative 30th day. For patients who were discharged before the postoperative 7th day, the tests were completed by telephone questionnaire.

Ethical Statement

The study was approved by the Institutional Review Board of Izmir Katip Celebi University and each patient gave written informed consent to participate. The study was planned and performed in accordance with the World Medical Association Declaration of Helsinki.

Data analysis

The power analysis for this study was based on the paper by Acıkel and colleagues [9]. In the Wilcoxon signed-rank test, calculated for 57 people, it is enough to determine the differences between the scales at a significance level of 0.05 (α) with a 95% power. The calculation was made with G * Power 3.1.9.7 package program.

We used the Shapiro-Wilk test to analyze the homogeneity of the variables. The Wilcoxon Signed-Rank test was used for the analysis of anxiety and depression differences before and after the operation. Between-group differences according to gender were analyzed using the Mann-Whitney U test. Spearman's correlation tests were used for the assessment of correlation. The Kruskal-Wallis test and Friedman's analysis were also used. Data analysis was performed using SPSS 24.0, and p-values <0.05 were considered statistically significant.

Results

Ninety-eight patients completed the tests and their full medical records were available at the data collection system of our hospital. Sixty of them were males, and 38 were females. Their average age was 46±6.54 years, ranging between 43 and 76 years. Nineteen of the patients were housewives, 29 were retired, 24 were self-employed and 26 had other professions. The average preoperative hospital stay was 4.92±2.71 days, and the average postoperative stay was 7.39±1.9 days.

Depression and anxiety scores are analyzed statistically. Average BAI was 5.91±4.7 preoperatively, which increased to 15.12±5.04 on the postoperative 3rd day. Average BDI was 3.9±3.58 preoperatively, which increased to 10.89±4.08 on the postoperative 3rd day. Statistical analysis of both BDI and BAI tests is summarized in Table 1. We found that the level of depression and anxiety symptoms was higher in the postoperative period than in the preoperative period ($p<0.001$). We found that the symptoms of depression and anxiety levels were lower in the preoperative period than in the postoperative days 3 and 7 ($p<0.001$). However, there were no statistical

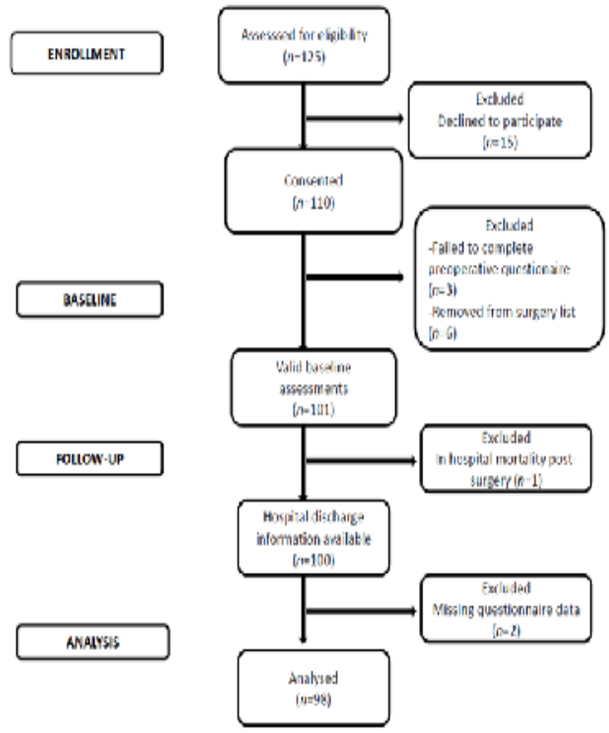

Figure 1. Study profile

Table 1. Statistical analysis of the anxiety and depression levels.

		Mean±SD	Min-Max	Median	Comparison
Beck's Anxiety Inventory	Preoperative period	5.91±4.7	0-37	5.5	p<0.00*
	Postoperative 3rd day	15.12±5.04	5.36	15	
	Postoperative 7th day	8.89±4.72	2.31	9	
	Postoperative 30th day	5.68±3.78	0-18	5	
Beck's Depression Inventory	Preoperative period	3.9±3.58	0-21	3	p<0.00*
	Postoperative 3rd day	10.89±4.08	3.24	11	
	Postoperative 7th day	5.41±3.5	0-21	5	
	Postoperative 30th day	3.64±3.32	0-16	3	

*Friedman's analysis. D=standard deviation

Table 3. Statistical correlation between age and Beck's depression and Beck's anxiety test values

		Age		Preoperative stay (day)		Postoperative stay (day)	
		rho	p*	rho	p	rho	p
Beck's Anxiety Inventory	Preoperative period	-0.021	0.83	0.59	<0.00*	0.02	0.78
	Postoperative 3rd day	0.27	0.007*	0.02	0.84	-0.05	0.58
	Postoperative 7th day	0.11	0.25	0.01	0.86	0.03	0.79
	Postoperative 30th day	0.01	0.85	0.22	0.02*	0.06	0.54
Beck's Depression Inventory	Preoperative period	-0.14	0.14	0.47	<0.00*	0.16	0.09
	Postoperative 3rd day	0.15	0.12	0.10	0.29	-0.07	0.48
	Postoperative 7th day	0.15	0.12	0.17	0.07	0.13	0.19
	Postoperative 30th day	-0.079	0.44	0.32	<0.00*	0.21	0.03*

*Spearman's correlation analysis

differences in depression and anxiety levels between the preoperative period and postoperative 30th days. The average BAI scores were 5.91±4.7 and 5.68±3.78 on preoperative and postoperative 30th days, respectively. The average BDI scores were 3.9±3.58 and 3.64±3.32 on preoperative and postoperative 30th days, respectively.

Anxiety and depression scores were analyzed and classified as cut-off scores. The percentage of scores are shown in Table 2. Correlations between preoperative stay, postoperative stay, age and anxiety, depression scores were analyzed with the Spearman correlation test. Positive correlations were found between preoperative stay and preoperative anxiety scores, postoperative 30th-day anxiety, preoperative depression scores, postoperative 30th-day depression scores. There were positive correlations between postoperative stay and postoperative 30th-day depression scores. There was also a positive correlation between age and postoperative 3rd-day anxiety scores. The results of correlations are shown in Table 3. There was no statistical difference regarding depression and anxiety scores between the genders. In a similar fashion, there was no correlation between profession and Beck's depression and Beck's anxiety test scores.

Table 2. Percentage of patients with symptoms of anxiety and depression in the preoperative and postoperative periods.

BAI scores	Preoperative period		Postoperative 3rd day		Postoperative 7th day		Postoperative 30th day	
	n	%	n	%	n	%	n	%
<8 normal	68	69.38	8	8.16	36	36.73	73	74.48
8-15 mild anxiety symptoms	29	29.59	43	43.87	58	59.18	22	22.44
16–25 moderate anxiety symptoms	-	-	44	44.89	2	2.4	3	3.6
26–63 severe anxiety symptoms	1	1.2	3	3.6	2	2.4	-	-
BDI Scores								
<10 normal	93	94.89	39	39.79	90	91.83	90	91.83
10–16 mild depressive symptoms	3	3.6	51	52.04	6	6.12	8	8.16
17-29 moderate depressive symptoms	2	2.4	8	8.16	2	2.4	-	-
30-63 severe depressive symptoms	-	-	-	-	-	-	-	-

Discussion

Depression and anxiety, before and during the recovery period, are as important as physical morbidities in determining outcomes such as the ability to function [10]. Many studies have shown depression prior to CABG to be a significant predictor of morbidity and mortality in the months and years following surgery [5,11], and similar effects have also been found for anxiety [12,13]. On the other hand, postoperative depression is a potential risk for cardiac events in the first year and 6-8 years after CABG [14]. Patients experience elevated feelings of anxiety both in the early and late postoperative period, between 10% and 20% of them show clinical levels of postoperative anxiety leading to disturbances in the healing period [15]. This study aims to define the course of depression and anxiety before and after CABG, and its relationship with demographic data and length of hospital stay in a sample of patients undergoing first-time, elective CABG.

In our study, both depression and anxiety scores have been found higher in the postoperative period than preoperative period (p<0,001). In other studies with high preoperative depression scores have a long preoperative hospital stay, and unfamiliar hospital environment may cause fear and stress [16,17]. We have the shortest mean preoperative hospital stay with 4.92±2.71 among the studies dealing with the length of hospital stay and depression. We assume that this is the main reason for the low baseline depression scores.

There is a significant increase in depression levels on the postoperative 3rd day, which reflects mild depression symptoms. This is consistent with recent papers [9,15,18]. The higher rate of depressed patients a few days after CABG is not surprising, as the depression scale contains items assessing somatic complaints such as sleep disturbances, loss of appetite, energy, and sexual drive [19]. Moreover, after the surgery, patients wake up in the intensive care unit, with no one familiar, separated from their families. In these circumstances, depression is thought as an understandable and inevitable reaction to CABG, and, as a result, is not treated most of the time [20]. Following that, in our study, the scores tend to decrease on the postoperative 7th day, and reach baseline levels on the postoperative 30th day. These findings corroborated other research that indicates about 20% of CABG patients were depressed postoperatively [19,21].

We found normal levels of anxiety preoperatively, and this may be explained by two main reasons. First, surgeons provide detailed information about perioperative outcomes to patients and their relatives in our clinic. A more certain knowledge about probable outcomes relieves anxiety. As a second reason, similar to depression, anxiety is high in CABG patients while they are on the waiting list with an unknown surgery date [22]. Short hospital stay in our clinic explains low anxiety scores in the study. In the same trend with depression, anxiety peaks on postoperative 3rd day, slightly decreases on postoperative 7th day, and returns to baseline levels at postoperative 30th day. Most of the previous studies have revealed a prominent decrease in the postoperative period [6,15,19]. Our results reflect the unsteady status of patients because of the “unknown” healing process. They do not know what to eat, how often to walk, when their incisions will heal, all of these are sources of anxiety in the very first part of the postoperative period. These differences from other studies may be explained by the performance of other scales, which do not include questions reflecting somatic disturbances.

In our study, there is a significant positive correlation between age and anxiety on postoperative 3rd day. There is no correlation between the preoperative test scores. In contrast, Krannich et al. showed that the younger the patients, the more the decrease in pre-post surgery depression and anxiety scores [6]. The authors speculate that younger patients might imagine a much greater loss while waiting for open-heart surgery. On contrary, Perski et al. showed that older patients more often suffered from depression than younger ones [22]. We think that the postoperative increase of anxiety in older patients in our study can be explained by the difficulties related to physiological changes in aging. Older patients more often tend to think that they would have no one to look after the operation, when younger people think they can handle it on their own.

Several studies have studied the association between hospital stay and depression/anxiety levels in cardiac surgery patients. Our findings are consistent with the study of Poole et al, which includes only the length of post-CABG stay [23]. We found that a longer postoperative stay leads to higher depression levels on the postoperative 30th day. In a study that aggregated length of stay data between 2007-2009 across 28 hospitals in the United Kingdom, the mean stay for the 19522 CABG patients was 12.48 days (SD=10.94) [23]. Our mean length of stay is 7.39, which can be explained by the fact that we recruited only first-time, elective patients. Likewise, we also have a short preoperative hospital stay, and our results reveal that the longer the preoperative stay, the higher the depression and anxiety scores, for both the day before surgery and postoperative 30th day.

As Acıkel et al. revealed in their results [9], no significant correlation was found between gender and profession separately and BDI-BAI scores in our study. Koivula et al. found no difference in the prevalence of depression by gender or employment status, as well [24]. In the study by McCrone et al., although no statistical difference was seen in terms of depression between the genders, postoperative anxiety scores were higher in women [10]. They interpret their findings with a small number of women in the sample, typical of other recent studies as well. Korbmacher et al. declared higher depression and anxiety results in the postoperative period for women, and likewise, they explained this by the fact that less than 27% of patients were females in their sample [25]. Our study with 38.8% of female patients is above the other ones, and power analysis showed that our numbers are more than enough to have reliable results. Unfortunately, we did not analyze age, profession, or length of stay regarding different genders, and this should be a topic for future research to enlighten the effect of gender on depression and anxiety with CABG patients. Study

Limitations

There are some strengths as well as weak points in our study. In terms of strengths, our study examined patients undergoing CABG in a single hospital and therefore removes the influence of inter-hospital variation in patient care. Moreover, both our sample size and the percentage of women are more than enough for reliable results, according to the power analysis,

which was performed prior to the study.

The BDI and BAI tests have been widely used in CABG patients so far. Both tests have questions that seek answers reflecting somatic and cognitive symptoms. Many of these somatic symptoms are characteristic of CABG patients in the postoperative period. This may be counted as a weak point of our study.

Conclusion

Between 30% and 40% of CABG patients experience depression and anxiety at rates significantly higher than prevalent in community samples [12]. Both depression and anxiety seem to confer greater morbidity and mortality, though behavioral and biological mechanisms are poorly understood. We believe that accurate diagnosis and intervention among CABG patients may impact distress levels, and surgeons are encouraged to establish referral and treatment pathways in collaboration with mental health professionals.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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